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FINAL REPORT  
FEBRUARY 1994

REPORT NO. 94-15

EVALUATION OF 1-1/4- VERSUS  
2-INCH METAL BANDING OF  
500-POUND MK82 BOMBS ON  
THE M127, M871, AND M872  
SEMITRAILERS TRANSPORTABILITY  
TESTS



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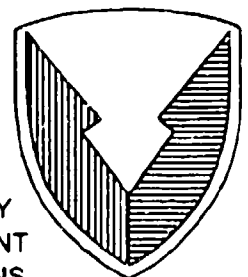


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VALIDATION ENGINEERING DIVISION  
SAVANNA, ILLINOIS 61074-9639

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<p>The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by USADACS, Transportation Engineering Division (SMCAC-DET), to evaluate the substitution of 1-1/4-inch metal banding in lieu of 2-inch metal banding in the road transportation of 500-pound MK82 bombs on M127, M871, and M872 semitrailers. The substitution is due to the nonavailability of 2-inch metal banding and the 2-inch metal banding being difficult to work with in the preparation of ammunition loads. Currently, two 2-inch metal bands are used to secure a load unit of two pallets of 500-pound MK82 bombs to a flatbed semitrailer for road transportation. These tests are to investigate the use of three 1-1/4-inch metal bands to secure 500-pound MK82 bombs to the M127, M871, and M872 semitrailers during road transportation. These tests document the load securing ability of three 1-1/4-inch metal bands versus two 2-inch metal bands.</p>					
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VALIDATION ENGINEERING DIVISION  
SAVANNA, IL 61074-9639

REPORT NO. 94-15

EVALUATION OF 1-1/4- VERSUS 2-INCH METAL BANDING OF 500-POUND  
MK82 BOMBS ON THE M127, M871, AND M872 SEMITRAILERS  
TRANSPORTABILITY TESTS

FEBRUARY 1994

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## PART 1

### INTRODUCTION

A. **BACKGROUND**. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by USADACS, Transportation Engineering Division (SMCAC-DET), to evaluate the substitution of 1-1/4-inch metal banding in lieu of 2-inch metal banding in the road transportation of 500-pound MK82 bombs on the M127, M871, and M872 semitrailers. The substitution is due to the nonavailability of 2-inch metal banding and the 2-inch metal banding being difficult to work with in the preparation of ammunition loads. Currently, two 2-inch metal bands are used to secure a load unit of two pallets of 500-pound MK82 bombs to a flatbed semitrailer for road transportation. By using three 1-1/4-inch metal bands, the same load securing ability is achieved.

B. **AUTHORITY**. This test was conducted IAW mission responsibilities delegated by U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL 61299-6000. Reference is made to Change 4, 4 October 1974, to AR 740-1, 23 April 1971, Storage and Supply operations; AMCCOMR 10-17, 13 January 1986, Mission and Major Functions of U.S. Army Defense Ammunition Center and School (USADACS).

C. **OBJECTIVE**. The objective of these tests is to validate the concept of using three 1-1/4-inch metal bands in place of two 2-inch metal bands in securing two pallets of 500-pound MK82 bombs to the M127, M871, and M872 semitrailers for road transportation. The test requirements are set forth in TP-91-01, Transportability Testing Procedures, July 1991.

D. **CONCLUSION**. After subjecting all test loads to the road hazard course and the 30-mile road trip and panic stops, no movement in any loads were observed and no loosening of the 1-1/4-inch metal banding was observed. One metal band slipped off a pallet loaded on the

M871 semitrailer at the end of the second pass over the road hazard course. The load proceeded over the washboard course with 1-inch forward movement. The banding was placed over the pallet at a dimension of less than 3-1/2 inches from the top pallet edge.

E. RECOMMENDATION. Recommend three 1-1/4-inch metal bands be used to secure two 500-pound MK82 bombs to the M127, M871, and M872 semitrailers for road transportation provided that the banding is 3-1/2 inches or more from the top edge of the pallet.

PART 2

22 FEBRUARY AND 21-23 MARCH 1994

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## PART 3

### TEST PROCEDURES

These procedures were extracted from TP-91-01, Transportability Testing Procedures, July 1991, for tactical vehicles used for shipping munitions by tactical truck.

A. All test loads were prepared using the drawing specified for the munitions (see part 5). The 500-pound MK82 bombs used in all loads were inert (nonexplosive). The weight and physical characteristics of the load configuration for all tests were identical to the live (explosive) ammunition provided for in the drawing in part 5; i.e., weights, physical dimensions, center of gravity (CG), etc.

B. Tests for this load configuration are as follows:

1. Road Hazard Course (Test Method No. 2).
2. Road Trip (Test Method No. 3).
3. Road Hazard Course (Test Method No. 2).
4. Washboard Course (Test Method No. 6).

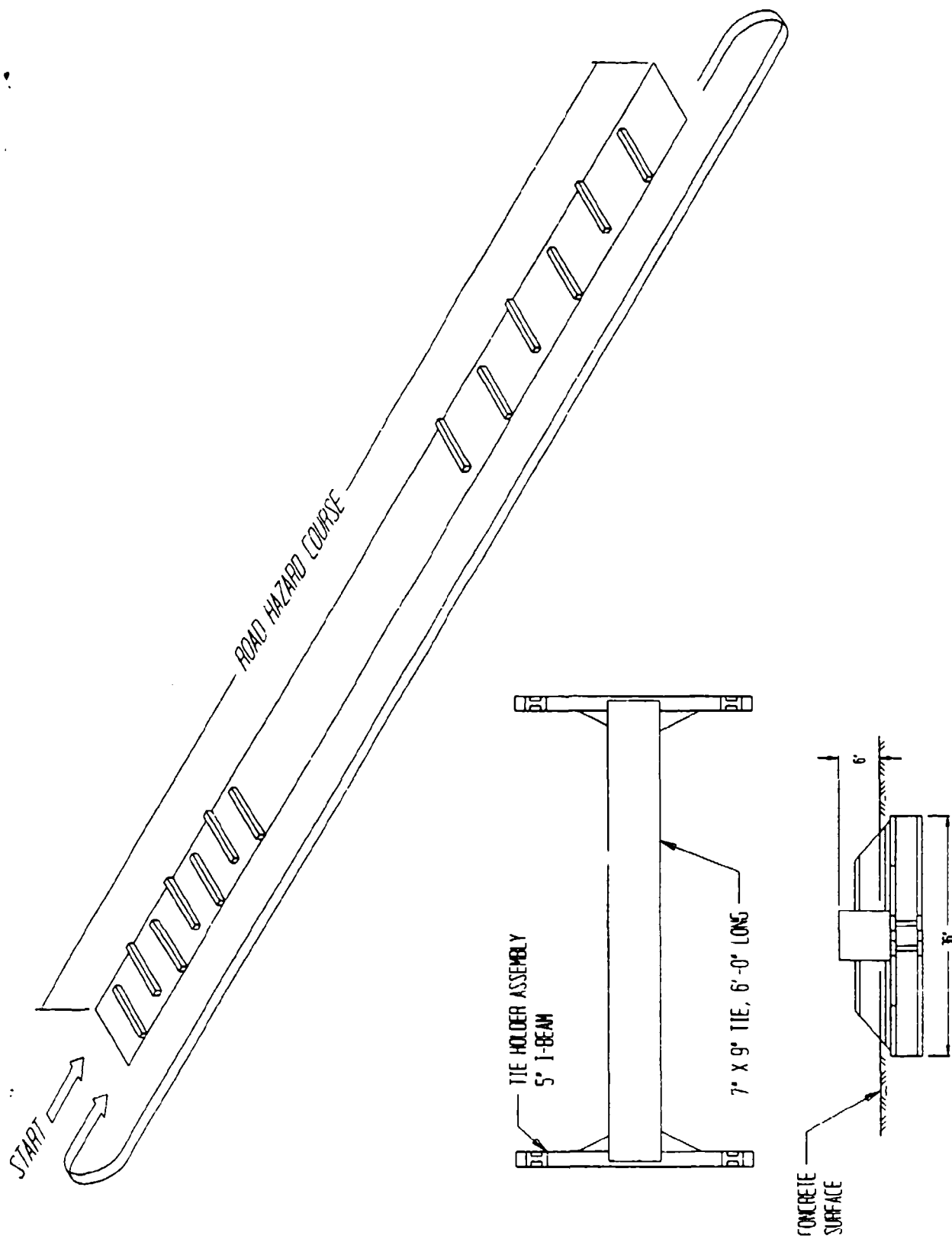
C. The test methods are as follows:

1. Test Method No. 2 (Road Hazard Course). This method required the bomb loaded semitrailer be pulled over the 200-foot-long segment of concrete-paved road which consists of two series of railroad ties projecting 6-inches above the level road surface. The semitrailer traversed this course two times. The road hazard course is constructed as shown in Figure 1, page 3-3.



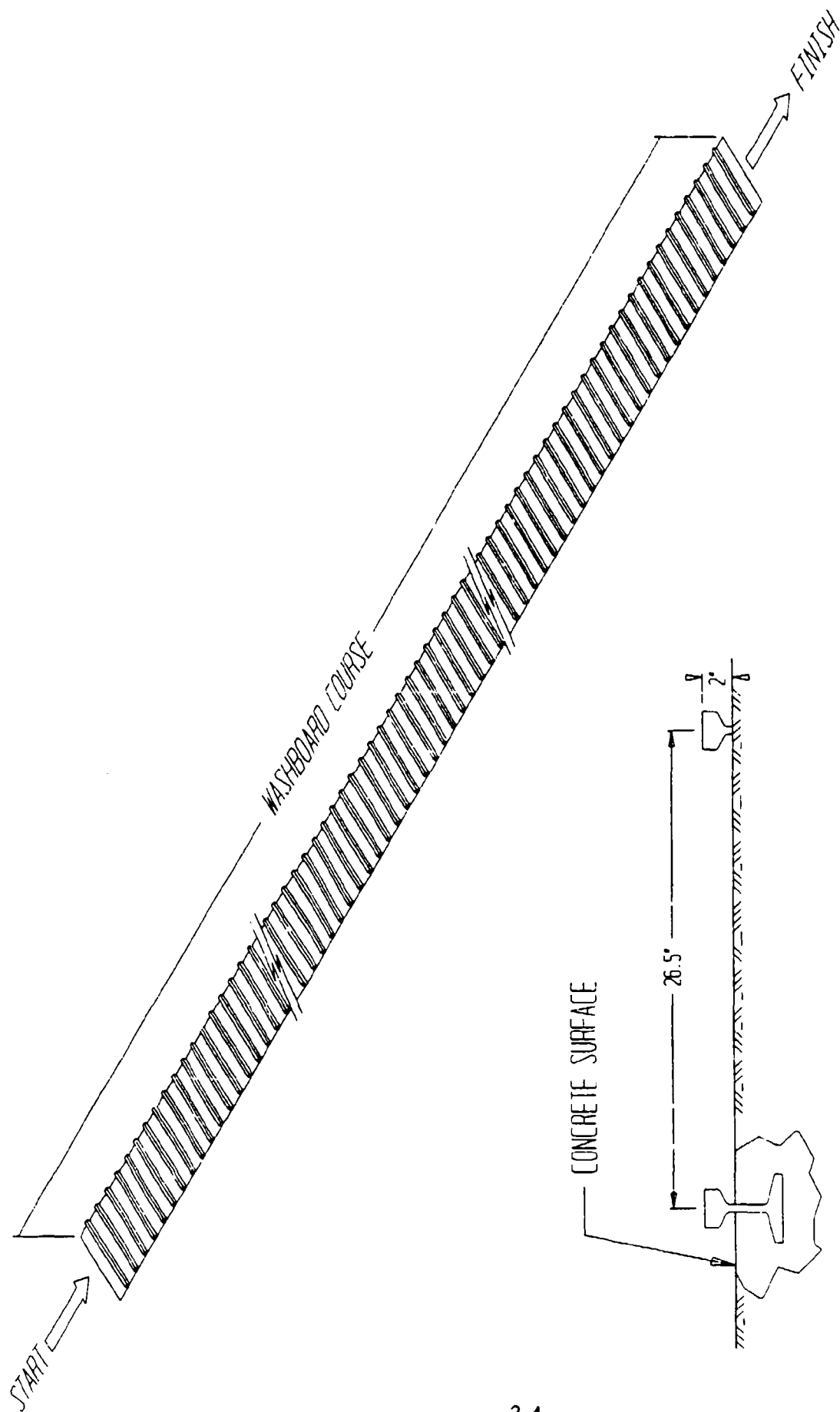
2. Test Method No. 3 (Road Trip). The semitrailer transported two pallets of MK82 bombs for a distance of 30 miles over a combination of roads surfaced with gravel, concrete, or asphalt. The test route included curves, corners, railroad crossings, cattle guards, and stops and starts. The load traveled at the maximum speed suitable for the particular road being traversed, except as limited by legal restrictions. Upon completion of the 30-mile road trip, the load was subjected to three full airbrake stops while traveling in the forward direction and one in the reverse direction. The first three stops were at 5, 10, 15mph, while the stop in the reverse direction was approximately 5mph.

3. Test Method No. 6 (Washboard Course). Each trailer load was driven over the washboard course at a speed that produced the most violent response of the vehicle. The washboard course is constructed as shown in Figure 2, page 3-4.



TIE HOLDER DETAILS

FIGURE 1



TYPICAL SECTION

FIGURE 2

## **PART 4**

### **TEST RESULTS**

#### **ROAD TEST DATA**

Test No.: 1

Date: 22 February 1994

Specimen Load: Two pallets of 500-pound MK82 bombs on an M127 semitrailer.

#### **ROAD HAZARD COURSE:**

PASS 1-A OVER FIRST SERIES OF TIES:	6.08 SEC	5.6 MPH
-------------------------------------	----------	---------

PASS 1-B OVER SECOND SERIES OF TIES:	6.29 SEC	5.2 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the semitrailer or load movement.

PASS 2-A OVER FIRST SERIES OF TIES:	6.89 SEC	4.9 MPH
-------------------------------------	----------	---------

PASS 2-B OVER SECOND SERIES OF TIES:	6.42 SEC	5.1 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

30-MILE ROAD TEST: No damage or load movement.

PANIC STOP TEST: At 5, 10, and 15 mph in the forward direction and 5 mph in reverse; no load movement or damage.

PASS 3-A OVER FIRST SERIES OF TIES:	6.20 SEC	5.5 MPH
-------------------------------------	----------	---------

PASS 3-B OVER SECOND SERIES OF TIES:	6.53 SEC	5.0 MPH
--------------------------------------	----------	---------

REMARKS: No load movement. Rear wheels fell off the M127 semitrailer. Test stopped.

## ROAD TEST DATA

Test No.: 2

Date: 21 March 1994

Specimen Load: Two pallets of 500-pound MK82 bombs on an M871 semitrailer.

### ROAD HAZARD COURSE:

PASS 1-A OVER FIRST SERIES OF TIES:	6.72 SEC	5.1 MPH
-------------------------------------	----------	---------

PASS 1-B OVER SECOND SERIES OF TIES:	6.85 SEC	4.8 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the semitrailer or load movement.

PASS 2-A OVER FIRST SERIES OF TIES:	6.54 SEC	5.2 MPH
-------------------------------------	----------	---------

PASS 2-B OVER SECOND SERIES OF TIES:	6.18 SEC	5.3 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

30-MILE ROAD TEST: No damage or load movement.

PANIC STOP TEST: At 5, 10, and 15 mph in the forward direction and 5 mph in reverse; no load movement or damage.

PASS 3-A OVER FIRST SERIES OF TIES:	6.32 SEC	5.4 MPH
-------------------------------------	----------	---------

PASS 3-B OVER SECOND SERIES OF TIES:	6.93 SEC	4.7 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

PASS 4-A OVER FIRST SERIES OF TIES:	6.10 SEC	5.6 MPH
-------------------------------------	----------	---------

PASS 4-B OVER SECOND SERIES OF TIES:	6.49 SEC	5.0 MPH
--------------------------------------	----------	---------

REMARKS: The rear band holding the MK82 pallets to the truck slipped off the pallet. Reason: the bands were initially placed less than 3 1/2-inches from the edge of the pallet top. No pallet damage.

WASHBOARD COURSE: The pallets slid approximately 1-inch forward during the pass over the washboard course. No pallet damage.

## ROAD TEST DATA

Test No.: 3

Date: 22 March 1994

Specimen Load: Two pallets of 500-pound MK82 bombs on an M872 semitrailer.

### ROAD HAZARD COURSE:

PASS 1-A OVER FIRST SERIES OF TIES:	6.50 SEC	5.2 MPH
-------------------------------------	----------	---------

PASS 1-B OVER SECOND SERIES OF TIES:	6.21 SEC	5.3 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the semitrailer or load movement.

PASS 2-A OVER FIRST SERIES OF TIES:	6.07 SEC	5.6 MPH
-------------------------------------	----------	---------

PASS 2-B OVER SECOND SERIES OF TIES:	6.09 SEC	5.4 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

30-MILE ROAD TEST: No damage or load movement.

PANIC STOP TEST: At 5, 10, and 15 mph in the forward direction and 5 mph in reverse; no load movement or damage.

PASS 3-A OVER FIRST SERIES OF TIES:	6.36 SEC	5.4 MPH
-------------------------------------	----------	---------

PASS 3-B OVER SECOND SERIES OF TIES:	6.06 SEC	5.4 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

PASS 4-A OVER FIRST SERIES OF TIES:	6.20 SEC	5.5 MPH
-------------------------------------	----------	---------

PASS 4-B OVER SECOND SERIES OF TIES:	6.55 SEC	5.0 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the pallets. The driver's side pallet moved 1/4-inch forward and 1/4-inch to the outside of the semitrailer. The curb side of the pallet moved 1/2-inch forward with no lateral movement.

WASHBOARD COURSE: No pallet damage or load movement.

## ROAD TEST DATA

Test No.: 4

Date: 23 March 1994

Specimen Load: Two pallets of 500-pound MK82 bombs on an M127 semitrailer.

### ROAD HAZARD COURSE:

PASS 1-A OVER FIRST SERIES OF TIES:	6.00 SEC	5.6 MPH
-------------------------------------	----------	---------

PASS 1-B OVER SECOND SERIES OF TIES:	6.78 SEC	4.8 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the semitrailer or load movement.

PASS 2-A OVER FIRST SERIES OF TIES:	6.98 SEC	4.9 MPH
-------------------------------------	----------	---------

PASS 2-B OVER SECOND SERIES OF TIES:	6.17 SEC	5.3 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

30-MILE ROAD TEST: No damage or load movement.

PANIC STOP TEST: At 5, 10, and 15 mph in the forward direction and 5 mph in reverse; no load movement or damage.

PASS 3-A OVER FIRST SERIES OF TIES:	6.07 SEC	5.6 MPH
-------------------------------------	----------	---------

PASS 3-B OVER SECOND SERIES OF TIES:	6.83 SEC	4.7 MPH
--------------------------------------	----------	---------

REMARKS: No damage or load movement.

PASS 4-A OVER FIRST SERIES OF TIES:	6.81 SEC	5.0 MPH
-------------------------------------	----------	---------

PASS 4-B OVER SECOND SERIES OF TIES:	6.30 SEC	5.2 MPH
--------------------------------------	----------	---------

REMARKS: No damage to the pallets or load movement.

WASHBOARD COURSE: No pallet damage. The driver side pallet moved 3/4-inch forward and the curb side pallet moved forward 1/2-inch. No measurable lateral movement was observed.

**PART 5**

**DRAWINGS**



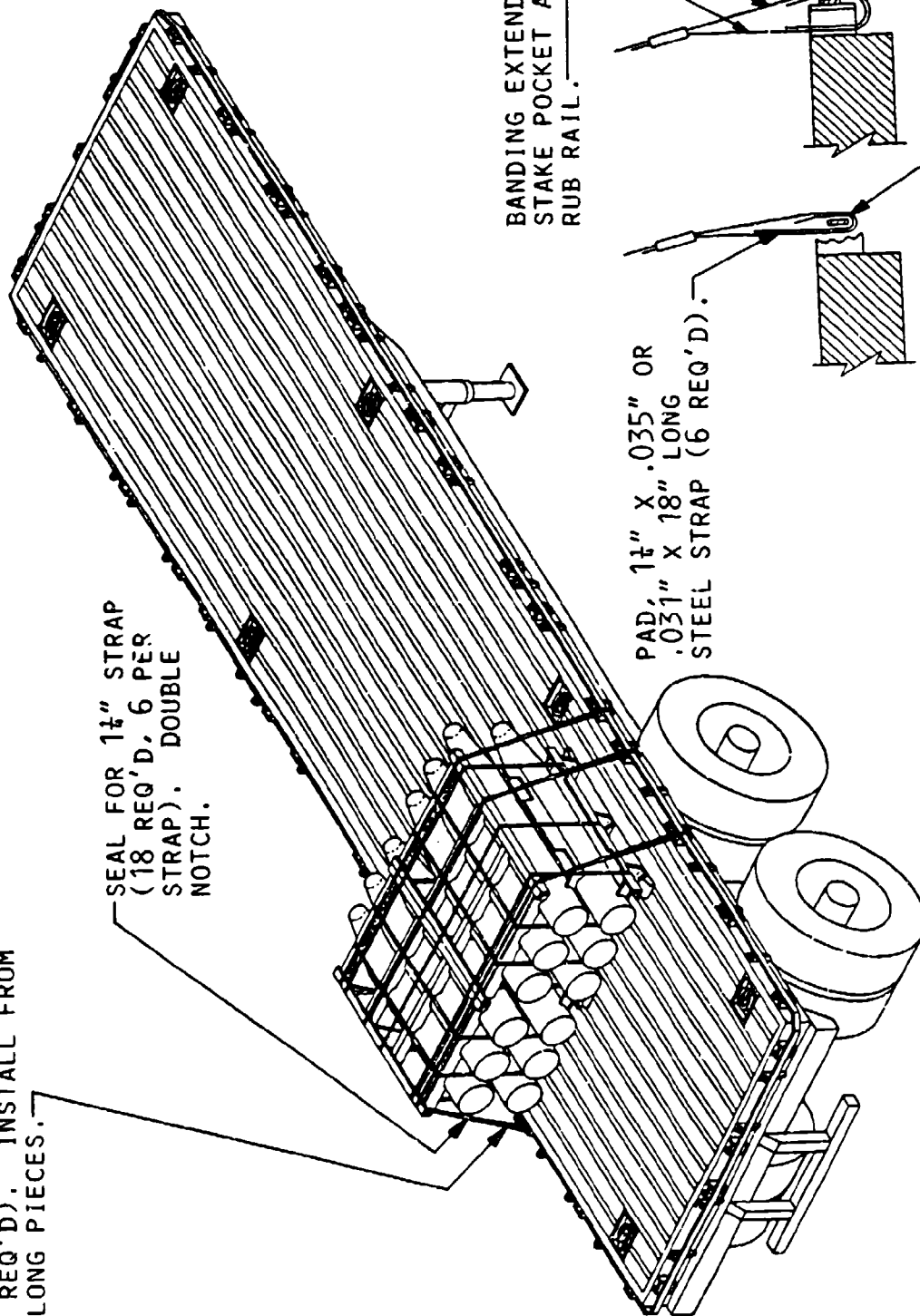
STEEL STRAP, 1½" X .035" OR .031" X 20'-0" (3 REQ'D). INSTALL FROM TWO 10'-0"-LONG PIECES.

SEAL FOR 1½" STRAP (18 REQ'D, 6 PER STRAP). DOUBLE NOTCH.

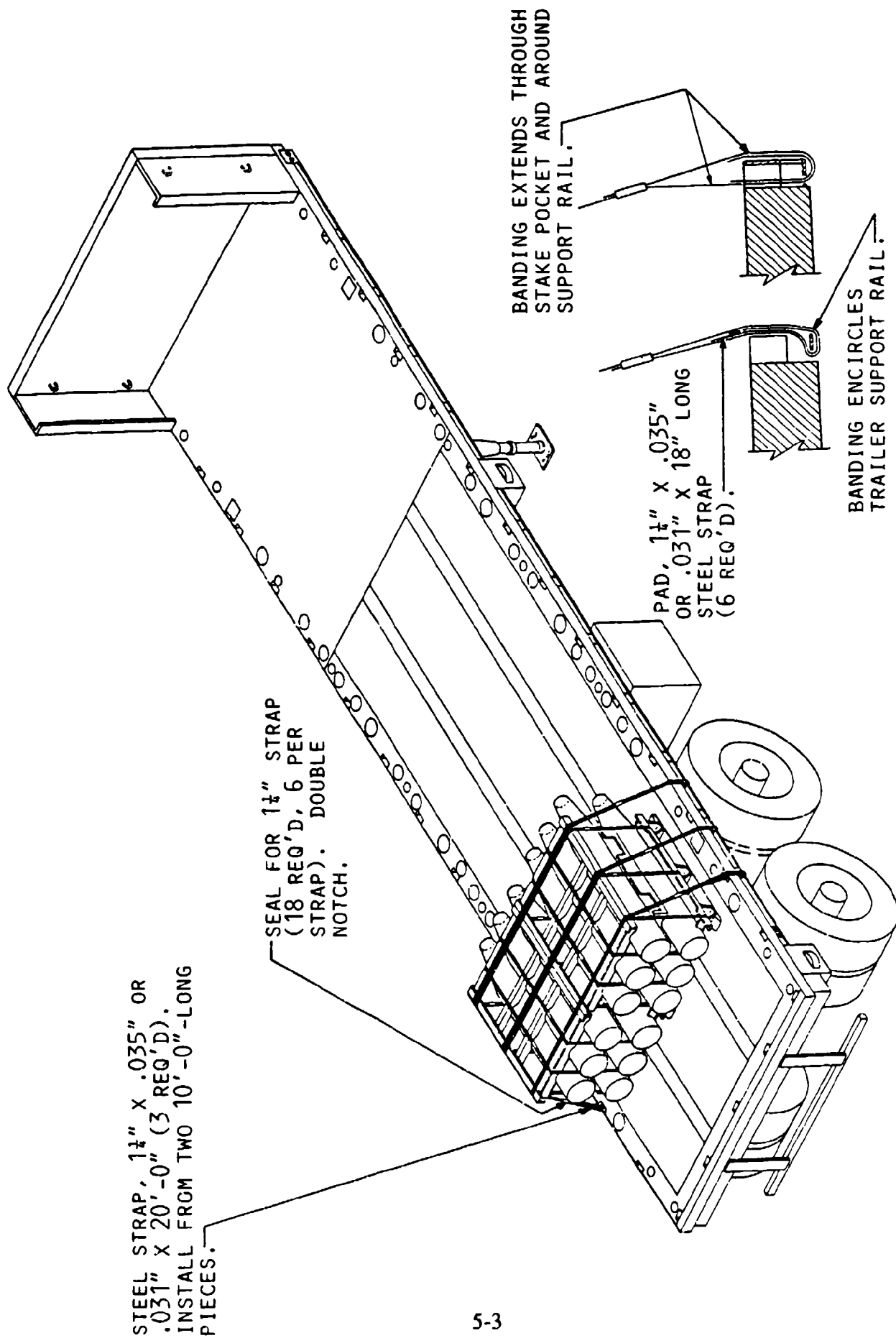
BANDING EXTENDS THROUGH STAKE POCKET AND AROUND RUB RAIL.

PAD, 1½" X .035" OR .031" X 18" LONG STEEL STRAP (6 REQ'D).

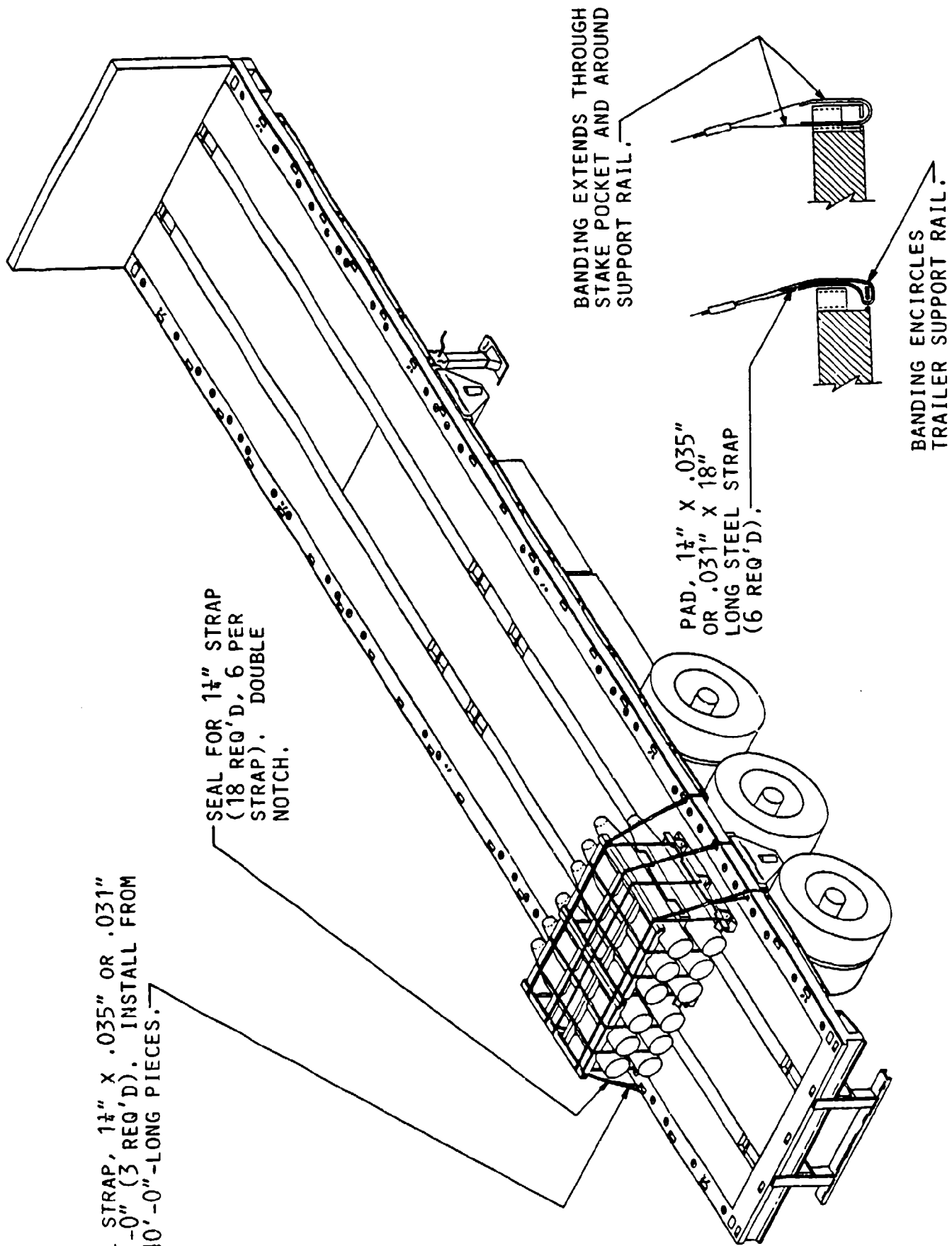
BANDING ENCIRCLES TRAILER RUB RAIL.



TWO PALLETES OF 500-POUND MK82 BOMBS ON AN M127 SEMITRAILER



TWO PALLETES OF 500-POUND MK82 BOMBS ON AN M871 SEMITRAILER



TWO PALLETS OF 500-POUND MK82 BOMBS ON AN M872 SEMITRAILER